

WHAT IS CLAIMED IS:

1. A compact chemical reactor comprising:

a first substrate having a first surface and a groove formed therein;

5 a catalyst layer provided on an inner surface of the groove formed in the first surface of the first substrate; and

a second substrate having a surface which contacts the first surface of the first substrate, and a concave portion formed in the surface to receive a portion of the catalyst layer.

2. The compact chemical reactor according to claim 1, wherein a width of the concave portion is set to be 105% or more larger than a width of the groove.

15 3. The compact chemical reactor according to claim 1, wherein the first substrate has a silicon substrate.

4. The compact chemical reactor according to claim 1, wherein the second substrate has a glass substrate.

20 5. The compact chemical reactor according to claim 1, wherein the first substrate and the second substrate are anode-connected.

25 6. The compact chemical reactor according to claim 1, wherein the catalyst layer has protrusions protruding outward from the first surface of the first substrate.

7. The compact chemical reactor according to claim 6, wherein the concave portion of the second substrate constitutes such a space as not to contact the protrusions.

5           8. The compact chemical reactor according to claim 1, wherein a flow path is formed in a space defined by the groove of the first substrate and the concave portion of the second substrate.

10           9. The compact chemical reactor according to claim 8, wherein the flow path is configured to allow a material containing hydrogen to flow as a fluid.

15           10. The compact chemical reactor according to claim 8, wherein the catalyst layer has a catalytic action which causes a chemical reaction to occur in the fluid flowing into the flow path.

          11. The compact chemical reactor according to claim 1, wherein a heat generation means is provided on a second surface of the first substrate, the second surface opposing the first surface.

20           12. The compact chemical reactor according to claim 11, wherein the heat generation means has a electrically resistive element.

          13. The compact chemical reactor according to claim 11, wherein the heat generation means heats by burning.

          14. The compact chemical reactor according to claim 13, wherein the heat generation means includes a

groove whose surface is formed in the second surface of the first substrate, a catalyst layer provided in the groove of the second surface, and a third substrate for burning having a concave portion to receive a portion  
5 of the catalyst layer for burning.

15. A compact chemical reactor system comprises a plurality of compact chemical reactors having:

a first substrate;

a catalyst layer provided on an inner surface of a  
10 groove formed in a first surface of the first substrate; and

a second substrate in which a concave portion to receive a portion of the catalyst layer is formed in a surface opposite to the first surface of the substrate  
15 and which contacts the first substrate on the opposite surface,

wherein at least some of the plurality of compact chemical reactors are arranged so that their grooves are coupled to each other.

20 16. The compact chemical reactor system according to claim 15, wherein each of the compact chemical reactors has one of a reforming reaction section, an aqueous shift reaction section and a selective oxidative reaction section.

25 17. The compact chemical reactor system according to claim 15, wherein the plurality of compact chemical reactors are configured by accumulating the compact

chemical reactors.

18. The compact chemical reactor system according to claim 15, wherein the plurality of compact chemical reactors have heat generation means.

5        19. The compact chemical reactor system according to claim 15, which further comprises a heat generation means including a groove whose surface is formed in the second surface of the first substrate, a catalyst layer provided in the groove of the second surface, and a  
10        third substrate for burning having a concave portion to receive a portion of the catalyst layer for burning.

20. A compact chemical reactor system comprising:

(a) a compact chemical reactor which includes:  
a first substrate;

15        a catalyst layer provided on an inner surface of a groove formed in a first surface of the first substrate; and

20        a second substrate in which a concave portion to receive a portion of the catalyst layer is formed in a surface opposite to the first surface of the substrate and which contacts the first substrate on the opposite surface, and

(b) a power generation means which generates electricity with a reformed material produced by a  
25        reaction in the compact chemical reactor.

21. The compact chemical reactor system according to claim 20, wherein each of the plurality of compact

chemical reactors has one of a reforming reaction section, an aqueous shift reaction section and a selective oxidative reaction section.

5        22. The compact chemical reactor system according to claim 20, wherein the power generation means has a fuel cell.